VERSION WITH MARKINGS TO SHOW CHANGES MADE

Page 1, paragraphs [0000.2] through [0002.5]:

[0000.2] CROSS-REFERENCE TO RELATED APPLICATIONS

[0000.4] This application is a 35 USC 371 application of PCT/DE 00/01626 filed on May 20, 2000.

[0000.6] BACKGROUND OF THE INVENTION

[0001] [Prior Art] Field of the Invention

[0002] The invention relates to a piezoelectric actuator, for instance for actuating a mechanical component such as a valve or the like[, in accordance with the generic characteristics of the preamble to the main claim].

[0002.5] Description of the Prior Art

Page 2, paragraphs [0005] and [0006]:

[0005] In the conventional way, until now it was possible to reduce such problematic effects only by employing very expensive materials, such as Invar, that have a negative temperature expansion. Another way was to connect a material of high temperature expansion in series with the piezoelectric element, but that reduces the rigidity of the system and hence the [ak] useful force.

[0006] [Advantage of the Invention] SUMMARY OF THE INVENTION

Page 5, paragraphs [0012] through [0015]:

[0012] In a first application of the piezoelectric actuator of the invention, the end of the piezoelectric element by which it rests on the pressure plate, and thus

exerts a force on the actuating element, can advantageously be disposed on the far side of the piezoelectric actuator in terms of the effective direction. In that case, the useful force of the piezoelectric actuator is a tensile force.

[0014] [These and other characteristics of preferred refinements of the invention will become apparent from the claims and the description and the drawings; the individual characteristics, each alone or a plurality of them in the form of subsidiary combinations, can be realized in the embodiment of the invention and in other fields and can represent both advantageous and intrinsically patentable embodiments for which patent protection is here claimed.]

[0015] [Drawing] BRIEF DESCRIPTION OF THE DRAWINGS

Page 6, paragraph [0016]:

[0016] Exemplary embodiments of the piezoelectric actuator of the invention with a narrow design, for instance for positioning a valve, will be explained herein below in conjunction with the [drawing. Shown are] drawings, in which:

Page 7, paragraph [0025]:

[0025] [Description of the Exemplary Embodiments] DESCRIPTION OF THE PREFERRED EMBODIMENTS

Page 8, paragraphs [0028] through [0031]:

[0028] The prestressing force F_7 of the spring 7 must be substantially less

than the prestressing force F_4 of the spring 4, so that for the maximum useful force $[F_{useful}]$ $\underline{F}_u$, in this case in the form a tensile force, of the piezoelectric actuator 1, the following equation applies:

$$[F_{useful}]\ \underline{F}_u = F_4 - F7$$

[0030] Figs. 2 and 3 each show an arrangement of barlike piezoelectric elements 2 and compensating elements 3 in a section along the line A-A in Fig. 1. The lead bondings 10, 11 of the piezoelectric elements 2 are done in the axis Y direction in the arrangement of Fig. 2, while lead bondings 12, 13 in Fig. 3 are done in the X direction.

[0031] In Fig. 4, an arrangement with hollow-cylindrical piezoelectric elements 2 and compensating elements 3 can be seen, again in a section along the line A-A of Fig. 1. In this arrangement, the lead bondings 14 and 15 of the piezoelectric [elements] element 2 are mounted on the radial side faces of the piezoelectric element 2.

Page 9, paragraphs [0032] through [0034]:

[0032] A second exemplary embodiment of the piezoelectric actuator 1 is shown in Fig. 5, in which the components that function the same are provided with the same reference numerals as for Fig. 1. In the arrangement of Fig. 5 as well, the piezoelectric element 2 is of a suitable piezoceramic; a compensating element 20, however, is also constructed [like] as a piezoelectric element, and in a modification

of the example of Fig. 1, these elements 2 and 20 are pressed by the spring 4 via the spring plate 5 against a fixation edge located at the top of the housing 6.

[0033] The piezoelectric element 2 is layered transversely, so that when an electrical voltage is applied, it lengthens, as in the first exemplary embodiment. The piezoelectric layers of the compensating element 20 are conversely longitudinally layered or stacked, so that they shorten in the effective direction when an electrical voltage is applied [of] to the piezoelectric actuator 1.

[0034] The prestressing force of the spring 7, by way of which the lower end of the piezoelectric element 2 rests on the housing, must be substantially less than the prestressing force of the spring 4, so that for the maximum useful [F_{useful}] force F_u, in this case in the form of a compressive force, of the piezoelectric actuator 1, the following equation applies:

$$[F_{useful}]\ F_u = F_7 - F_4$$

Page 11, paragraph [0038]:

[0038] The foregoing relates to preferred exemplary embodiment of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.

Page 16, abstract:

Abstract of the Disclosure

A piezoelectric actuator[, for instance] for actuating a mechanical component[, is proposed in which] includes a piezoelectric element [(2)], for subjecting an actuating element [(9)] to a tensile force or compressive force, and a compensating element, with [(3; 20) are present;] the piezoelectric element [(2)] and the compensating element [(3; 20) have] having essentially the same coefficients of temperature expansion. The compensating element [(3; 20)] is mechanically coupled to the piezoelectric element [(2)] in such a way that the temperature-caused expansions of the piezoelectric element [(2)] and of the compensating element [(3; 20)] cancel one another out in the effective direction in such a way that the actuating element [(9)] remains in its position.

[(Fig. 1)]